**Path Integral Formulation of GF**

So say we have some Hamiltonian,



And we want to evaluate the time ordered GF [going to presume fermions, but bosons can be done by basically taking spins off]:



where |GS> is the interacting ground state. Then following manipulations analogous to the ones made for the single particle. Basically, to write it as a path integral, we must relate to a bosonic/fermionic coherent state. And we use the supposition that in the long time limit, we can neglect overlap between any state other than the GS, because the others will have much higher oscillation frequency. So we start with two arbitrary field states |ψσ,a> and |ψσ,b>. Recall that |ψσ> = |ψ↑>|ψ↓> is an eigenstate of the two operators σ(x) for all x (and σ).



which allows us to conclude,



Using these identities, we can manipulate it into the form:



And inserting resolutions of identity into this expression, we can massage it into the following form, as was done for the propagator (probably should see that file in this folder),



Now we explicitly take the ta,b 🡪 ∞ limit, and recognize that apparently in this limit, the identity of the |ψσ,a(**x**)>, |ψσ,b(**x**)> is pushed to irrelevance, we get just get:



where,

